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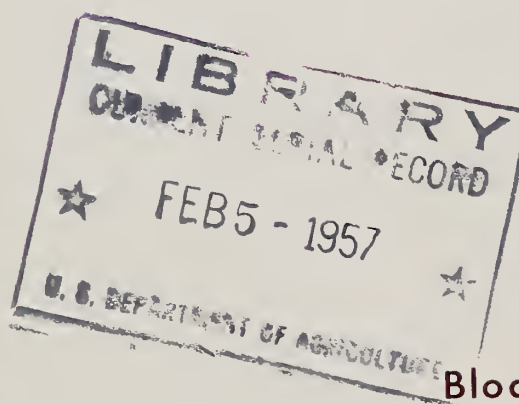
AGRICULTURAL Research



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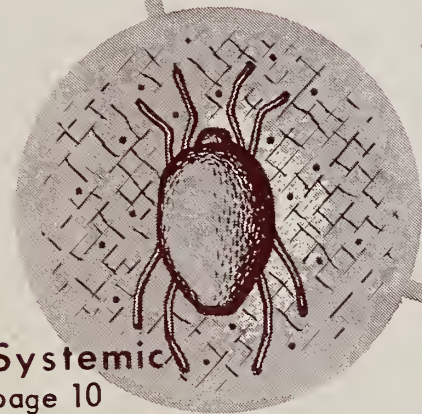
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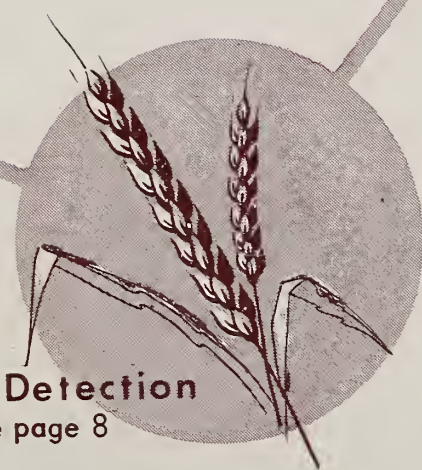
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UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL Research

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Weed Move

Five billion dollars a year! That's what weeds cost this country's farmers. Surprisingly, though, it's only in the last decade or two that we have been able to work up an effective organized effort against this age-old enemy.

An amazing chemical—2,4-D—gave us the first glimpse of the weed-control revolution that has swept our farms.

Today, a maturing weed science must consider the unmeasured possibilities of chemicals—and *broaden beyond*.

For one thing, we need to look closer at *all* the *tools* of weed control. There's a place in research for tillage measures, management, and cropping practices as well as chemical herbicides. Scientists must measure each of these tools.

In California, ranchers use machines, fire, and good agronomic practices along with chemicals to control brush on range lands. Chemicals hold only part of the answer.

Something else we need to do is *relate* weed control to other practices such as land preparation, seeding, and harvest. Several methods of weed control might be equally good ways to get rid of weeds—but one method might be far better than the others in terms of crop or farm management.

Take weeds in soybeans or corn in North Central States: the first cultivation comes at haymaking time. Preemergence chemical weed control lets a farmer delay or pass up this first cultivation. Economic studies should establish the interrelationship of weed control with other practices.

Still another need is more emphasis on *basic* research. Gains are going to come more and more slowly unless basic research lays a foundation of knowledge on which to draw.

We must know more about weed plants themselves—factors in germination, effects of temperature and light and moisture on dormant seeds, rate of plant growth. With chemicals so important, we need to learn more about how they penetrate a plant, their movement and action in relation to their structure, how these herbicides and soils affect each other.

Meeting these needs will require scientists from many fields. And it will take time. So it's important to move now. Farmers, realizing how much weeds cost, want answers.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

PROTEIN versus GOSSYPOL

High level of good protein helps pigs gain efficiently and resist toxicity of material that holds down the use of cottonseed meal



■ **GOSSYPOL TOXICITY** in swine is related not only to how much protein is in the diet but also to the quality of the protein, according to recent findings in USDA research.

Gossypol—polyphenolic compound in pigment glands of cottonseed kernels—is toxic to nonruminants, such as swine and poultry. Presence of this toxic material has prevented wide use of cottonseed meal as a main supplemental protein for these animals. Reduction of gossypol without impairing the nutritive value of cottonseed meal would greatly improve the meal and widen its usefulness.

Various processing measures—solvent extraction, hydraulic press, and particularly screw press—have been modified to reduce active gossypol. But certain processing conditions such as heat and moisture may injure protein quality and nutritive value of the cottonseed meal. So the proteins of commercially processed meals may vary widely in biological value (usually measured by nitrogen solubility, even though this correlation does not always follow).

Gossypol's toxicity studied

ARS biochemist Imogene P. Earle and animal husbandman J. W. Stevenson of the Agricultural Research Center, Beltsville, Md., have been studying relationships between the level and quality of dietary protein in swine and the development of gossypol toxicity. Previous work here had already shown that there is not always a correlation between amount of free gossypol in cottonseed meal and

toxicity in animals. Recent studies on protein-depleted rats showed further that resistance to gossypol toxicity is generally lower on proteins having a low biological value.

Tests cover range of meals

Researchers fed 3 lots of 35-pound pigs (18 per lot) with 3 different cottonseed meals supplied by the cooperating Southern Utilization Research Branch, New Orleans. These meals ranged from CM 13, a poor meal with a nitrogen solubility of only 30 percent, to CM 45, a good meal with a nitrogen solubility of about 65 percent. Also used was a combination of CM 13 and a very high quality experimental butanone-extracted meal. Diets of the 6 pigs in each of the lots were adjusted to 1 of the 3 levels of protein—20, 17, or 14 percent.

Enough gossypol was added to the animals' diets to provide 0.015 percent free gossypol—a level that's frequently found to be toxic in diets containing 18 percent protein.

The beneficial effect of increased protein level on resistance to gossypol toxicity was clearly demonstrated and quite marked. The good-quality CM 45 meal and the combination mixture were about equal in their growth-promoting value and efficiency of feed utilization when tested on both growing pigs and rats. CM 13 was inferior in both respects.

Test animals fed CM 45 gained most weight, averaging 1.289 pounds daily, and were most economical in feed utilization, averaging 2.97 pounds of feed per pound of gain.

Animals fed CM 13 gained least weight, averaging .814 pound daily, and were the most uneconomical feeders, averaging 3.93 pounds of feed per pound of gain. Pigs fed the combination meal gained 1.246 pounds daily and used 3 pounds of feed per pound of gain. Animals gained most weight at the 20-percent protein level in all cases, least weight at the 14-percent level in most cases.

The length of time animals lived on their diets showed which meals best promoted gossypol tolerance.

Animals first to die of gossypol toxicity were those that were fed poor-quality CM 13 or the combination mixture—along with a low-protein diet. Animals that ate CM 13 or the combination mixture—but on a high-protein diet—lived a little longer. And those animals that were fed good-quality CM 45—on all 3 of the protein levels—lived longest of all.

Tolerance related to protein

At the end of 97 days, only 1 pig out of the 18 on CM 45 had died of gossypol poisoning, 9 of 18 on CM 13 had died, and 6 of 18 on the combination meal had died. The surviving animals were slaughtered on the 98th day and showed every evidence of being completely normal. This indicates that if the quality of protein in cottonseed meal can be improved, considerably higher levels of gossypol will be tolerated by animals.

In the future, we may expect improvement in processing conditions, which should result in cottonseed meals of uniformly good quality. ☆

What about Bloat?

Beltsville studies on the feedlot type of this complex disorder are giving us new light on its patterns—but no full answer yet



FEDERAL-STATE research is slowly uncovering some facts on one of the oldest and most common disorders of livestock the world over—bloat.

Bloat in this country alone results in losses of some \$40 million yearly due to death and decreased production. Although a large percentage of these losses occur on legume pastures, bloat in the feedlot can mean the difference between profit and loss. In addition, knowledge gained in feedlot-bloat studies can often be applied to research on costly pasture bloat.

Recent USDA work on feedlot bloat has shown it to be highly complex and caused by several interacting factors, many of which are not well understood. Need for further research is shown by the fact that bloat dates back to Biblical times. Up to now—some 2,000 years later—little is known about its causes, prevention, and precise methods of treatment.

ARS biochemist I. L. Lindahl and animal nutritionist R. E. Davis of the Agricultural Research Center, Beltsville, Md., and dairy nutritionists D. R. Jacobsen and J. C. Shaw of the Maryland Agricultural Experiment Station, College Park, recently completed studies on animal and dietary factors responsible for feedlot bloat.

Bloat is produced in tests

In preliminary studies on diet composition, these researchers produced frothy bloat in 11 animals by feeding them daily 14 pounds of concentrate (61 percent barley, 22 percent alfalfa meal, 16 percent soybean oil meal, and 1 percent sodium chloride) and 4 pounds of alfalfa hay. In general, the substitution of corn for barley, or of alfalfa hay for alfalfa meal, had no particular effect on bloating.

Test animals that were kept on a bloat-producing diet 4 or 5 months

suffered bloat more often and more severely than animals on a similar diet for a shorter period of time. After 4 or 5 months, however, when animals seemed to reach bloat equilibrium, the frequency and severity of bloat tended to be fairly constant.

Total feed intake and bloat severity were found to be unrelated during the first 4 or 5 months of the diet. But a relationship between feed intake and bloat severity *was* found to exist after animals reached bloat equilibrium at 4 or 5 months.

Animals differed greatly in their susceptibility to bloat. This difference could not be correlated with their eating habits or total food intake, which suggests that the tendency to bloat may very well be inherited.

Contractions show increase

Ruminal contractions definitely increase in frequency as animals be-

1. Swelling on animal's side is typical of bloat, reaches peak usually within 1 hour after a feeding. Fistula—the hollow, pipe-like bulge on animal's left side—opens directly into rumen, through a steel cannula.

2. Pressure reading is taken by gauge placed upon fistula over the swollen rumen, and shows extent of ruminal pressure created by bloating. A reading of about 30 millimeters of mercury, as shown, means moderate bloat.

3. Sampling of ruminal contents is obtained by opening stopcock on fistula, allowing contents to pour out. Rapid opening of the stopcock causes froth and gas to escape and slow opening causes the gas to escape first.



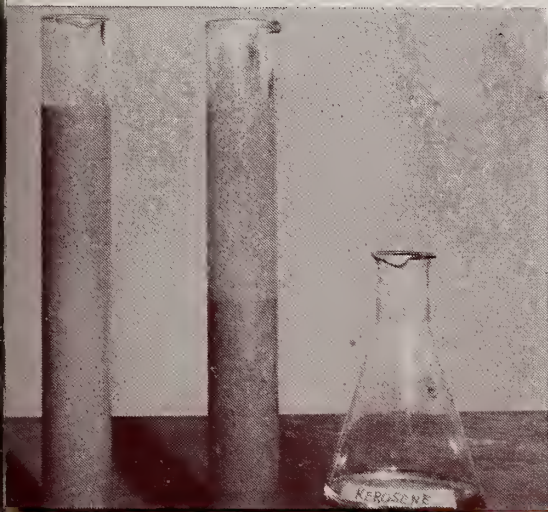
gin to bloat. This basic pattern of rumen motility showed no apparent changes in tests on an animal that ate a low-fiber bloat-producing diet for a long time. Data on the metabolic activity of the ruminal microorganisms and the physical nature of the ruminal contents definitely show changes when the animals are fed the bloat-producing diet. These changes were correlated with the incidence and severity of the bloat.

Several aspects under study

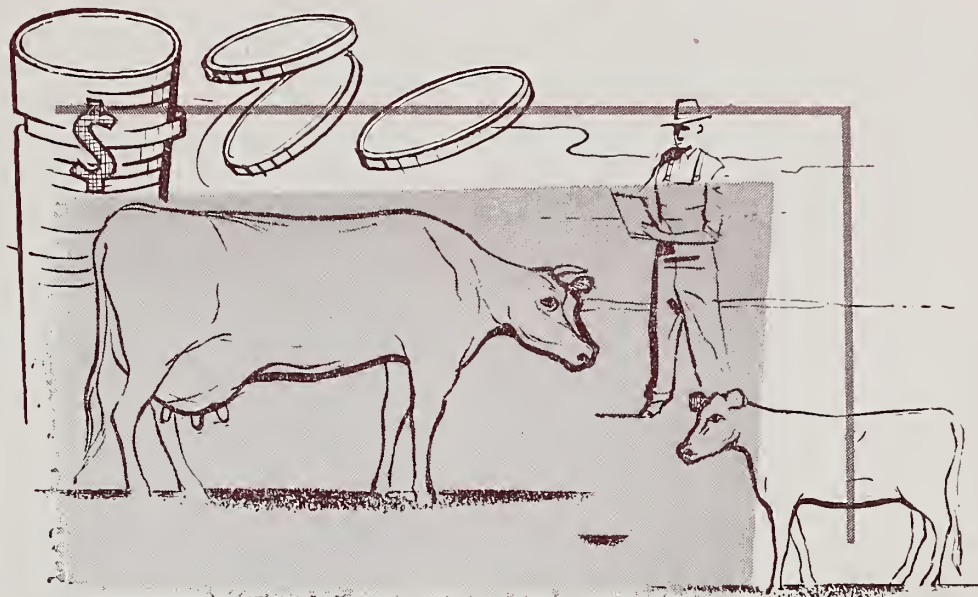
Intensive studies by USDA and co-operating State agricultural experiment stations are currently underway on a number of the biochemical, physiological, bacteriological, and pathological aspects of pasture and feedlot bloat. It is hoped that this all-out attack will soon result in better understanding of the causes of bloat and lead to development of definite methods of preventing and treating this costly disorder of livestock.

No definite recommendations for treatment can be offered at present. Bloat can be relieved—as it was in the Beltsville work—by use of a large-size stomach tube. This is believed to be the safest method right now. Bloat can sometimes be successfully treated with kerosene, turpentine, and other surface-active agents. These substances apparently break up the rumen froth that prevents the animal from belching.☆

4. Ruminal contents from animal with feedlot bloat look spongy (left). Treatment with kerosene—one effective old remedy—reduces the froth volume by half (right). Kerosene breaks down the gas bubbles trapped in froth.



Herd Replacements— BUYING BEATS RAISING



■ NEW ENGLAND DAIRYMEN may find buying replacement cows more profitable than raising them. It may also pay these farmers to send heifers to mature on neighboring farms. And small dairymen forced out of business by new milk-handling methods and the trend to higher capitalization could profitably raise these replacements.

These are the results of a USDA survey (ACR. RES., May 1954, p. 11) conducted by agricultural economists G. E. Frick, of ARS, and W. F. Henry, of the New Hampshire Agricultural Experiment Station.

Within the framework of current prices and technology, commercial milk producers would find a shift from raising to buying replacements economically advantageous in the long run. Of course costs might rise with increased demand for replacement cows by dairymen in the area.

New England studies show net income is increased by shifting from raising to buying replacements, although barn and grazing facilities may be available. In general, it pays to carry as many producers as possible, even if this means raising fewer or no replacements.

Both raised and purchased cows produce about the same amount of milk and are equally free of diseases such as brucellosis.

Purchased cows have a longer productive life than raised animals. Raised heifers freshening at 2 can be expected (by statistics) to live another 4.1 years, or a total of 6.1 years. On the other hand, the average age at which cows are last purchased for a herd is 4 years. At this age, she has a life expectancy of 3.2 years. This makes 7.2 years, or 1.1 more than the total for raised cows. These purchased cows have survived the test of earlier culling in other herds.

Whether cows should be raised or purchased for herd replacements depends on the quantity and flexibility of resources on the farm. Of farmers surveyed, 85 percent had enough labor to handle an extra 17 purchased cows per farm, enough barn space for 10 more, and some good forage that could be used to carry either cows or young stock. ☆

ELEVATOR EASE FOR POTATOES

From deep storage to processing is a smooth trip with this device



1. Potatoes are moved by water flume from deep storage bins to this draper-chain feeder. Slat-type elevator buckets, geared to feeder, are loaded up without overfilling.



2. Elevator, which moves potatoes from lower to upper levels of the plant, was developed by USDA at Red River Valley Potato Research Center, East Grand Forks, Minn.

3. Emptying of buckets onto conveyor belt takes place on way up, minimizing potato bruising (usual discharge method calls for emptying on way down). Elevator consists of two end-less motor chains running parallel to each other. Buckets are attached between chains, and a variable-speed drive moves chains and buckets around sprockets at 30 to 90 feet per minute.



■ AN ELEVATOR that improves the movement of potatoes from deep storage bins to upper-level washers has been designed by USDA researchers.

With the trend toward washing and packaging potatoes for consumer sales, a shift from small portable equipment to stationary washing and packing lines has occurred. In two-floor commercial plants, potatoes must move from the lower to the upper floors where washers are located.

The new elevator was developed by agricultural engineers A. D. Edgar, of the Agricultural Marketing Service, and A. H. Glaves, of the Agricultural Research Service, and horticulturist J. C. Hansen, of AMS.

Potatoes are fed into modified (slat-type) buckets and raised with the elevator to the upper level. Here the buckets move horizontally and are tipped so the potatoes spill gently on a conveyor belt moving to the washer. Injury to potatoes is minimized since the elevator does not dump them from sufficient height to bruise them.

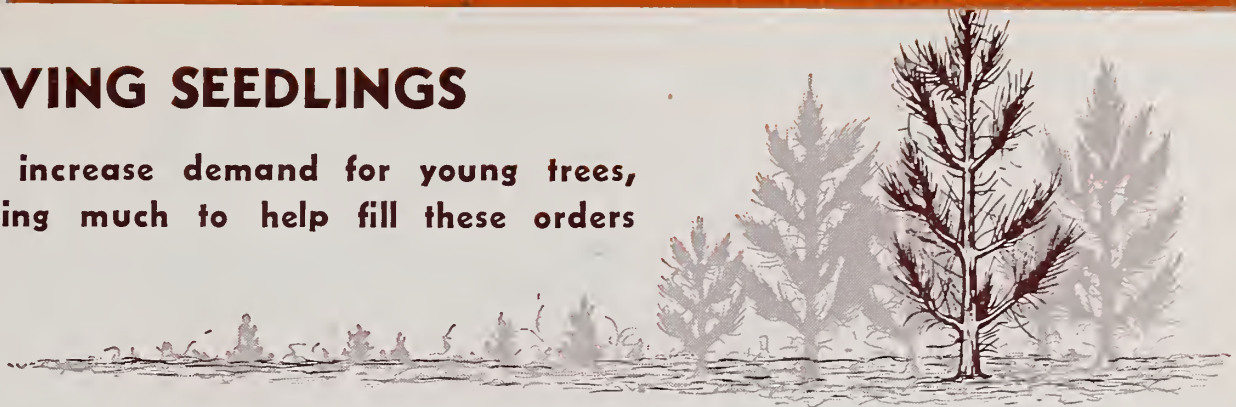
Operating speed varies to meet packing-line requirements. If the quality of potatoes is poor, they must be delivered to the washing and packing line at a slower rate to permit proper sorting. If quality is good, potatoes may be delivered faster to fully utilize workers' time.

The draper-chain feeder, which is geared to the elevator, is the most effective type of feed regulator.

Commercial storage and packing houses have been installing the elevator for approximately \$1,000. The unit may be built from commercially available parts by a shop mechanic, or custom made at a machine shop. AMS Marketing Research Report No. 131 gives detailed information.☆

Foresters are SAVING SEEDLINGS

Soil Bank plantings increase demand for young trees, and research is doing much to help fill these orders



■ RESEARCH ON insects and diseases affecting tree seedlings gains new importance as farmers transfer low-value and surplus cropland to forest growths under the Conservation Reserve section of the Soil Bank.

Farmers scheduling future planting are taking advantage of inducements to retire croplands to grass and trees. USDA's Forest Service expects requests for a billion seedlings annually above the present demand.

As more trees are planted, the application of research findings increases. On California brush fields, where ponderosa and Jeffrey pine had been planted, the pine reproduction weevil became a serious pest.

But scientists have now developed a hybrid pine—a cross between the Jeffrey and the Coulter—that is resistant to the insect and, at the same time, could be a good timber tree. The Coulter alone is resistant to the pine reproduction weevil but has poor growth qualities. The Jeffrey possesses good growing characteristics but is highly susceptible to the weevil. Seedlings of the hybrid were recently

PINE REPRODUCTION WEEVIL

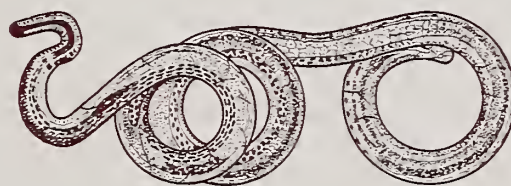


planted in some sections of California on an experimental basis.

Nematodes have become a greater problem in nurseries of the warm south, now that more seedlings are

being raised for planting on farms and larger commercial woodlands. But experiments at the Southeastern Forest Experiment Station in Asheville, N. C., show that nematodes infecting slash and sand pine seed-

NEMATODE



lings may be destroyed by heat treatment. When roots are immersed in hot water at 116° F. for 17 to 25 minutes, nematodes are destroyed without affecting survival of the seedlings.

Other work at the Southeastern station includes planting seedlings earlier than has been practical in pine areas where pales weevils exist. Pine seedlings along the eastern coast and as far west as Texas are infected if planted the first summer after cutting or after fires, scientists say.

Pales weevils feed on the tender bark of young seedlings, girdling and killing the plants. Eggs are laid in roots of dying trees or in pine stumps. Grubs developing from these eggs feed on the inner bark of the stumps and deeply engrave sapwood of the roots where the bark is thin. Larvae take several months to complete feeding, change to pupae, and emerge as adult pales weevils ready to attack.

If planting is delayed a year, the insects do not feed on the seedlings or lay eggs in the stumps to such an extent. But the delay causes a year's

loss of growth, increases planting costs, and provides time for hardwood species to take over acreage that could be planted with pine seedlings. Consequently, researchers are trying insecticides as a protection against pales weevils so that planting could follow immediately after cutting or after fires, eliminating the delay.

Both benzene hexachloride and dieldrin show promise as a spray and for treatment of the soil around seedlings. Dieldrin also is effective for dipping prior to planting.

Still other research is underway to protect seedlings planted under the Soil Bank. The Forest Service, working with the Soil Bank, is financing the expansion of State nurseries and the

PALES WEEVIL



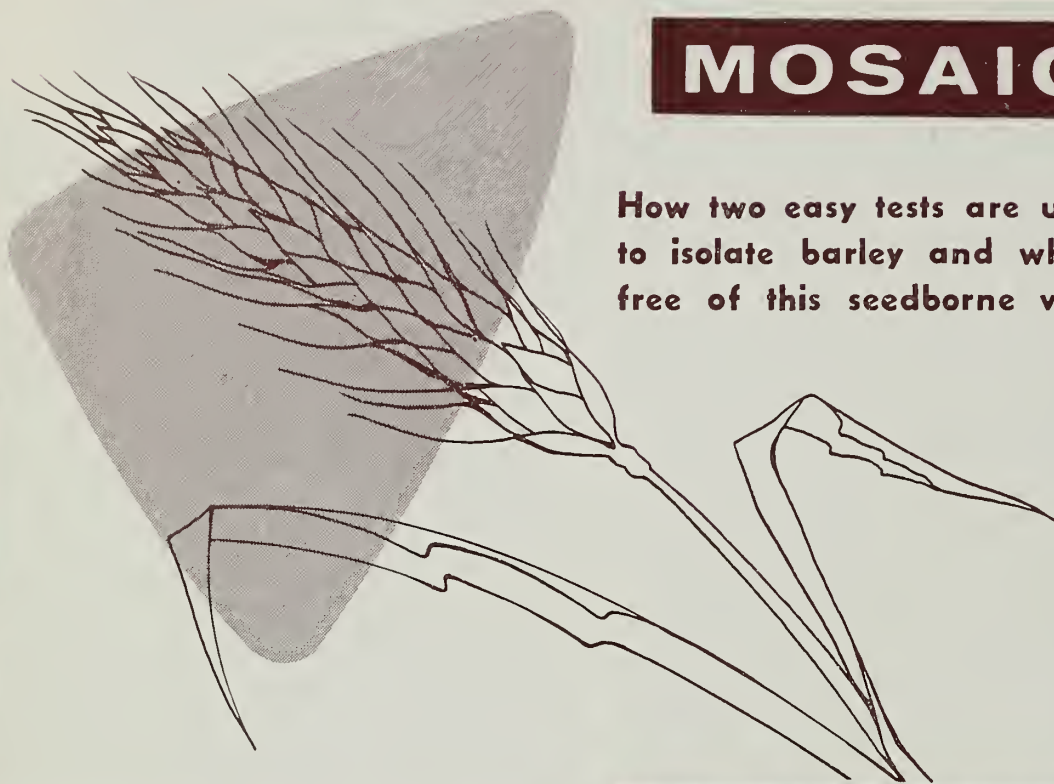
establishment of new ones so that an adequate supply of forest seedlings will be available under the program.

Cutover lands can be restored to forest by nature through seeds from trees left standing, but planting of seedlings from nurseries helps obtain selective stocking and gets land back into production faster. The Forest Service reports that 10 percent of the commercial timberland, or some 50 million acres, needs stocking. Under the Soil Bank, another 5 million acres could be converted from cropland to forest planting by farmers.☆

Simple ways to find

STRIPE MOSAIC

How two easy tests are used to isolate barley and wheat free of this seedborne virus



■ TWO NEW RESEARCH weapons against stripe-mosaic (false stripe) disease of barley and wheat have been developed at USDA's Agricultural Research Center, Beltsville, Md.

The weapons are simple, easy-to-do tests that identify plants infected with mild or latent strains of the seedborne virus. These tests provide a practical and effective method of selecting virus-free plants of commercial varieties for use in building up supplies of healthy crop seed for distribution to growers of barley and wheat.

Stripe-mosaic disease, ranging from mild to severe, is widely distributed in barleys throughout the United States. Distribution in wheat is not yet clearly known, but experiments with several commercial varieties indicate that mild forms of the disease may be cutting yields more seri-

THE BLOCKING TEST

Infection with mild strain of stripe-mosaic virus protected barley 1 against later inoculation with virulent strain. Barley 2, virus free when inoculated with virulent strain, became infected and showed strong symptoms.

THE BLOCKING TEST requires only healthy tester (highly susceptible) plants and a virulent strain of the stripe-mosaic virus. The test is based on McKinney's discovery that a barley or wheat plant infected with a mild form of the virus is immune to a severe form. The mild virus blocks further infection by the virulent strain. Thus, if a plant inoculated with a virulent strain does not come down with the disease, chances are the plant was already infected with a mild or latent strain of stripe-mosaic virus.

All seedlings that show signs of the disease are removed from a given lot, and the apparently healthy ones are planted far enough apart to prevent interplant contact. Since the object is to obtain virus-free plants, the selected seedlings cannot be inoculated *directly*. Instead, juice is pressed from a sample leaf of each plant and inoculated into virus-free

tester seedlings of barley or wheat. (Thorough sampling is important because the virus may not be present in all leaves of a mildly infected plant.) After 10 days, if these inoculated seedlings show no sign of the disease, they are inoculated with a virulent strain of the virus.

If they still fail to react, the virulent strain must have been blocked by a mild strain transmitted in the juice from the selected plant. The plant is therefore considered a virus carrier and is discarded.

On the other hand, if inoculated seedlings develop stripe mosaic, no blocking has occurred. The selected plant is considered healthy and suitable for producing virus-free seed.

The selected plants can be sampled and tested several times, and the tester plants can be inoculated with the virulent strain at least twice to detect possible virus infection escapes.



ously than has been supposed. In recent tests with Rushmore wheat, for example, an extremely mild strain of the stripe-mosaic virus reduced yields about 30 percent. In Pilot, infected with a natural mixture of mostly very mild and semivirulent strains, yield of grain went down 64 percent.

Stripe-mosaic virus is the only virus known to be carried in the seed of a grass species. Since there is no known method of killing the virus in the seed, selection of virus-free plants is the only means of combatting this important disease of cereal crops.

Falling yields suggest virus

Mild or latent strains of the virus produce few or no visible symptoms, even in highly susceptible varieties of wheat and barley. But scientists have suspected for some time that a virus is

causing the progressively lower yields in certain areas planted to particular varieties. Farmers say the varieties are "running out," but there is no sound genetic explanation for the claim. It now looks as if an answer to some of these situations has been found in these symptomless strains of the stripe-mosaic virus.

The new methods of detecting plants carrying mild or latent strains of the virus were developed by ARS pathologist H. H. McKinney. He describes them as "insurance against passing very mild strains that do not come to expression in our most sensitive tester plants." In other words, they are used as supplementary tests in routine indexing of plants for freedom from the disease.

The only methods now available for screening out these mild viruses in-

volve serological testing (AGR. RES., February 1956, p. 3) or the use of an electron microscope. Both require highly skilled scientists and expensive equipment—all badly needed for more fundamental research work.

New methods easy to learn

McKinney's tests—the "blocking test" and the "synergy test"—are so simple that any high school graduate can learn to run them under minimum supervision (see photos).

McKinney and associates at Beltsville have isolated virus-free plants of several wheat and barley varieties and are beginning to increase seed for larger-scale field tests at cooperating State agricultural experiment stations. Compana and Wintex barley and an Agropyron-wheat hybrid are among those that have been screened so far.

THE SYNERGY TEST

The synergy test is a rather radical departure from the conventional concept of screening disease-free plants. It is based on another McKinney discovery: that plants infected with both stripe-mosaic virus and brome-mosaic virus produce accentuated reactions. That is, the two viruses team up and pack a bigger wallop than either can alone. So McKinney used the brome-mosaic virus to betray the stripe-mosaic virus into showing itself.

To run the test, brome-mosaic virus is inoculated directly into the selected plants. Those already infected with mild or latent stripe-mosaic virus become severely stunted and show heavy chlorotic markings on the leaves. These plants are marked as virus carriers and should be discarded.

A "mild" reaction indicates that the plant is infected with the brome virus only. Thus, these plants are considered free of stripe-mosaic infection

and good for propagating purposes. (The brome-mosaic virus is not seed-borne; therefore, it will not affect subsequent yields of grain.)

The synergy test requires less time and work than the blocking test and may prove to be more practical, the Beltsville researchers believe.☆

Healthy-looking Atsel barley plant 1 is free of virus infection. Plant 2, somewhat retarded in growth, is infected with a very mild or a virulent strain of barley-stripe-mosaic virus. Stunted to a similar extent is plant 3, which is infected with the brome-grass-mosaic virus. In plant 4 are seen the accentuated reactions that occur when a plant is infected with both the mild strain of barley-stripe-mosaic virus and the brome-grass-mosaic virus at one time.





COTTON PLANTS grown from seeds that were not treated with systemic insecticides were susceptible to insects under laboratory tests and in the fields of 13 Cotton Belt States. Thrips attacked these leaves during experiments conducted on farms in Texas.

TREATING SEEDS with Thimet or Bayer 19639 provided excellent control of pests on seedling cotton for 4 to 6 weeks, both in laboratories and in fields. Lint tests conducted by Agricultural Marketing Service showed no adverse effect on grade or staple.



INSECT CONTROL by SEED TREATMENT

Treating seed with systemic chemicals controlled insects on plants in promising large-scale tests

■ **SUCH INSECTS** as thrips, aphids, and spider mites have been controlled in cotton by treating the seeds before planting, USDA and several State agricultural experiment stations report. ARS entomologists say two systemic chemicals—Thimet and Bayer 19639—have given promising results.

These systemic insecticides find their way into the sap stream and are translocated to different parts of the cotton plant. Then insects that feed on the plants are killed.

Farmers in 13 cotton-producing States, cooperating with the State experiment stations or State extension services, planted several thousand acres with treated seed in 1956 (AGR. RES., August 1955, p. 16).

Thrips, aphids, and spider mites were controlled for 4 to 6 weeks after plants emerged. Fair to good control was also obtained for a limited time against cutworms, the cotton leaf perforator, flea beetles, leaf miners, darkling beetles, false wireworm adults, and the brown cotton leafworm. At some locations, the cotton fleahopper was controlled for 4 weeks, and in some fields there was only minor white-fly damage. Effect on the boll weevil varied from field to field.

Farmers satisfied with test

Germination was reduced 35 to 40 percent in some fields. In others, there was no effect. Fruiting also varied, depending somewhat on soil

conditions. Some growers reported an increase in height of plants. A survey conducted in central Texas shows 83 percent of the farmers satisfied with the overall results.

Thimet was slightly more effective in controlling thrips, and Bayer 19639 was slightly better in controlling aphids, based on infestation records, plant heights, and bloom counts. With other insects, both chemicals had about the same effect.

Seeds are mixed with the chemical in a specially designed machine a few days to a few weeks before planting. Activated carbon, a highly adsorptive material that slowly releases Thimet or Bayer 19639, is used as a carrier. Methyl cellulose or other stickers are added so that these mixtures will adhere better to the cotton seeds.

Lab demonstrates systemic

The idea of treating seeds to prevent subsequent insect infestation in a growing plant was first demonstrated in 1949 by entomologist William Iglinsky at the ARS Basic Research Laboratory for Cotton Insects, College Station, Texas. Previously, systemic insecticides were applied to the foliage or to the soil and absorbed into the sap stream.

Thimet and Bayer 19639 are among the most poisonous insecticides recommended for general use on cotton. Growers can buy these dangerous chemicals only after they have been mixed with the seeds. The treatment adds about \$3 per acre to the cost. But the 2 to 4 sprays usually applied to cotton foliage early in the growing season may be eliminated.

Research is underway for types of carriers and methods of application that might extend control to longer than 4 to 6 weeks. Systemic seed treatment is also being tried against insects on alfalfa, cabbage, tobacco, citrus and deciduous fruits, potato seed pieces, onion sets, snap and lima beans, and other crops. ☆



MOSQUITOES down—YIELDS up

■ IRRIGATION PRACTICES good for crop yields minimized mosquito breeding in experiments by USDA and the U. S. Public Health Service in the Milk River Valley of Montana.

Mosquitoes reduce farm income by annoying farm workers, livestock, and poultry and by transmitting diseases including encephalitis (sleeping sickness) to man and animals. Mosquito breeding can be prevented if water is removed from fields within 4 or 5 days—before larvae mature. Therefore, correct irrigation to eliminate standing water increases incomes by insuring healthier livestock and poultry and more efficient labor.

The Public Health Service has found that 90 percent of farmstead mosquito breeding in the Valley resulted from irrigation and 70 percent occurred on irrigated fields.

Water pools on low ground

The cooperative study was made on an old meadow having a substantial stand of western wheat grass and other

native grasses on a compact clay soil. The meadow had not been leveled and the practice was to irrigate more than necessary to insure proper wetting of the higher elevations. This resulted in pooling of excess water on low ground, which not only provided good mosquito breeding sites but also killed much of the desirable grass.

Excess water poorly used

To simulate the common practice, ARS irrigation engineer S. Davis and his cooperators at Chinook, Mont., gave the plots a single irrigation, letting the water flow 2 or 3 weeks. They put on 30 or more inches of water. Plants used only 19 percent of it. That's unprofitable. Water stood in low places for well over a month, produced several broods of mosquitoes, and killed good grass.

On adjacent plots, researchers used three improved practices. They fertilized, especially with nitrogen, to build up roots and increase vegetation. They put up borders or dikes

to divide the field for even water distribution. And they made timely irrigations when the grass had extracted about 60 percent of available moisture from the root zone—3 to 8 saturations of the soil taking about 7 hours or less each and a total of only about 18 inches of water for the entire season. There was no runoff, so drains were not needed.

The soil had cracked before irrigation and opened a multitude of tiny reservoirs to catch and hold the water. Properly irrigated grass used two-thirds of the water applied—used it $3\frac{1}{2}$ times as efficiently as under poor irrigation. And water ponded for only about 53 hours—too little time for mosquitoes to mature.

Good water practices pay

Such management improves production and water economy on high-value crops, including good grass. But comfort and health of people and thriftiness of stock freed from mosquitoes are incentive enough.☆



Is SOYBEAN CHLOROSIS bad?

■ CERTAIN STRAINS of nitrogen-fixing bacteria and certain soybean varieties nodulated with these bacteria have been found responsible by USDA researchers for widespread chlorosis in southern soybeans. This condition has caused some concern for the past 2 years—and last summer

alarmed growers of the new Lee soybean in the Mississippi Delta area.

Although the abnormal appearance of affected plants is spectacular, agronomists believe the chlorosis doesn't affect yield appreciably.

This type of chlorosis shows up rather suddenly as a yellowish-white

area either around the border or in the center of growing leaves at the top of the plant. The condition arises in plants about 6 to 8 weeks old and lasts a week or two. Green color then returns just as rapidly. While some plants are recovering, others may be yellowing. Chlorosis is often inter-

mittent through a field, so soil condition or other environmental factors naturally were suspected at first.

Bacteria bring on condition

Some light was shed on this matter in 1954-55 studies of *Rhizobium japonicum* bacteria by ARS agronomist G. H. Abel and bacteriologist L. W. Erdman. They field-tested 80 strains of the bacteria at Brawley, Calif.—where soil completely lacked soybean types of root bacteria. This showed which strains were best for inoculating soybean seeds in the Southwest. Abel also found much chlorosis from inoculations with certain strains, none from others. That did not, however, definitely rule out soil or other environmental causes.

A rhizobium strain from a non-chlorotic field was tested on 40 soybean varieties in the greenhouse and caused little or no chlorosis in any plants. But 2 selected rhizobia from chlorotic fields, tested on the same 40 varieties, caused chlorosis in certain soybeans, yet proved to be excellent symbionts with other varieties. In brief, there was severe chlorosis in 6 varieties, light to medium chlorosis in 17, and little or no chlorosis in the other 17 varieties of soybeans. The 6 highly susceptible ones were Lee, Ogden, Roanoke, and Gibson and 2 experimental lines.

Agronomist H. W. Johnson, who collaborated in this work, says the chlorosis occurs prominently in only a few southern soybean varieties,

especially Lee, Ogden, and Roanoke. It had been observed in Ogden and Roanoke in scattered fields for several years. Plantings of Lee, introduced in 1954, had so much chlorosis that growers began questioning its dependability. Lee is resistant to several diseases, is nonshattering, and is very productive. Fortunately, we now find it can still be grown.

No serious results expected

The researchers don't think this chlorosis will become serious. Although they have not yet investigated the possibility of replacing the offending rhizobia already in the soil, they now know that necessary source material is available for developing resistant soybean varieties.☆



FINANCING Farm Adjustments

■ A SOUND farm-adjustment plan—together with adequate credit over a period of years—can often improve a farmer's income, says USDA production economist F. L. Garlock.

Adjustment plans may involve shifting from cash crops to dairy, beef, or poultry production. Plans may include shifts from work animals to machine power, or changes in numbers of livestock, acreages of crops, tillage practices, or size of farm.

Take the case of a farmer in western Tennessee operating an 80-acre upland farm on a cash-crop basis. ARS studies conducted in cooperation with the Tennessee Agricultural Experiment Station show the farmer may be able to double family earnings by developing beef and poultry enterprises to supplement his cotton crop. To develop these enterprises, he would need to more than double his invest-

ment in the farm. The additional capital would be used to improve pastures, to construct fences and buildings, and to purchase machinery, equipment, beef cows, and poultry.

Most operators could not make such an adjustment in a short period without borrowing most of the additional capital they would need to invest. Nor could they repay quickly the amounts borrowed. For financing major farm adjustments of this kind, farmers need credits that are repayable over a period of years.

A farmer can take several steps to improve his chances of getting the required credit on repayment terms that are best suited to his needs.

Lender should see full plan

He can avoid piecemeal borrowing. This refers to financing one purchase at a time without explaining long-

range plans to the lender. Instead, a farmer might preferably develop a complete plan for the adjustment, along with a budget of estimated receipts and expenditures. This would help the lender to analyze the practicability of the farmer's plan and the farmer's ability to repay a loan.

Arrange all credit at start

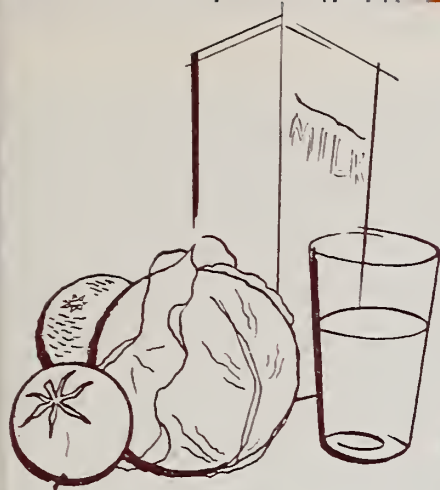
Before the adjustment begins, the farmer can try to arrange for all necessary credit and a repayment schedule based on ability to pay.

Borrowing could be concentrated at one institution instead of split among several. Then the lender will be able to work out a schedule based on the farmer's entire income.

Back of all this, it will help if the farmer can show a record of good farm management and prudence in handling his financial affairs.☆

OLDER PEOPLE need DIET HELP

They must keep intake low—but get protective foods



■ HOW CAN OLDER folks get enough of the nutrients they need for good health without gaining weight?

Easy-to-use diet patterns would be one way to help keep energy intake low—yet emphasize milk, foods rich in vitamin C, and other “protective” foods often neglected at present.

This is one of the conclusions drawn from findings so far published from regional research on nutritional status of older people in relation to their dietary intake. Work was conducted by Western and North Central groups of State agricultural experiment stations with USDA cooperating. Results have already been published from studies in California, Iowa, Michigan, Missouri, Nebraska, South Dakota, and Wisconsin.

People studied ranged from 30 to over 90 years old. In California, men and women were included; elsewhere, all participants were women.

Researchers found that from one-fourth to one-half the people in the different studies were overweight. Results already published from Iowa indicate that diets chosen by women who consciously lowered their total calorie intake in order to control body weight provided less than desirable amounts of calcium, vitamin C, and some other important nutrients.

Low calorie intake revealed

For Iowa women studied, the most popular foods were fats, bread, meat, potato, and desserts other than fruit, in that order. For South Dakota

women, more than 60 percent of the calories in the average diet came from sweets and desserts, cereal products, and table fats. In spite of the popularity of such foods, calorie intakes in these 2 States averaged little above 1700 a day for all ages combined. Energy intakes decreased with age.

When women in each age-decade were considered separately, it was found that the calories in their diets were considerably less than the National Research Council's Recommended Daily Allowances of 2300, 2100, and 1800 calories for women at ages 25, 45, and 65 respectively. Lack of physical exercise—due to increasing use of modern labor-saving devices, automobiles, and the like—may account for the otherwise paradoxical situation of so much overweight in the face of so many diets running low in energy value.

Calcium below the standard

The average calcium intakes of Iowa and South Dakota women were also far less than that recommended by the National Research Council.

ARS home economist Esther L. Batchelder points out that these evidences of calcium-low diets in older people provide a good reason for public health workers, community nutritionists, teachers, and other leaders to encourage milk drinking. Producers and processors of milk and cheese might help promote consumption and increase their sales by making products suit people's needs. The nonfat

dry milk now available is an example of convenient, economical food of special value for overweights.

Too little vitamin C eaten

Another nutrient—vitamin C—was often found low in older persons' diets, especially at low incomes. In California, men in a county home showed a definite relationship between low vitamin C intake and low blood-serum ascorbic acid, and between low serum levels and poor conditions in teeth and gums. About half the men with lowest serum ascorbic-acid levels had no teeth; of those with teeth, almost half had inflamed gums. Women in all States from which results on vitamin C have been reported received on the average insufficient amounts of this nutrient from usual diets.

New products such as frozen and dried citrus concentrates and other dependable, convenient, and inexpensive year-round sources of vitamin C may help to step up consumption.

Only a few of the findings have been cited above. When all results are published, researchers will have additional tools for evaluating dietary data, improving methods in field and laboratory, and planning new research to answer many questions still in our minds. For community nutritionists and teachers, the information justifies continued emphasis on milk and vitamin-rich fruits and vegetables for older people. The data should also interest those concerned with food processing and service. ☆

Cleaning Cotton Carpets— Better, Quicker

**Process allows quick drying,
should step up use of cotton**

■ A RECENTLY-DEVELOPED way to clean soiled wall-to-wall cotton carpeting has been improved to provide very rapid drying. This greatly increases the usefulness and commercial potential of the cleaning procedure.

Use of this method (AGR. RES., February 1956, p. 15) eliminates the overwetting and browning that take place with conventional cotton carpet cleaning. New feature of this procedure—developed through USDA contract research—provides for 2-hour drying and restoration of pile.

Quick drying may help increase utilization of cotton carpets in hotels, stores, and office buildings. Cotton carpets are not commonly used in these places because the loss in earning capacity of rooms—due to prolonged drying—cannot be tolerated.

Large quantities of fresh suds are applied to the carpet pile in the new process. Suds and soil are sucked up through a vacuum nozzle around the brush. Silica gel laid between layers of cotton batiste then quickly takes up most of the moisture.

This location cleaning and drying method and specially designed equipment were developed by the Hoover Co., North Canton, Ohio, under contract with the ARS Southern Utilization Research Branch, New Orleans.

Carpet cleaners have expressed interest in commercial potential of both the scrubbing and drying procedures; the fast-drying process may be adopted in cases where adoption of the scrubbing unit is delayed.☆



1. Scrubbing unit has airblower (on handle) that forces air into sudsmaker in center of brush. Detergent in container (left) also goes into sudsmaker, through rubber hose connected to scrubbing unit. Suds and dirt are removed after cleaning to a wet vacuum machine (right). A silicone defoaming agent in this machine liquifies all suds removed.



2. A specially pregenerated detergent flows from screened exit of sudsmaker. Radial channels aid suds flow from center to outside of rotating brush. The clean suds are thoroughly worked through the carpet pile. Suds and dirt are picked up almost instantly through the plastic bellows-type vacuum nozzle surrounding the outer edge of the brush.

3. Bamboo rake loosens the matted wet pile of the scrubbed carpet, facilitating the drying operation. The cotton carpet can be cleaned and dried usually in one house call with this new method; up to three calls are sometimes necessary with conventional ways. The new method cleans better, dries faster, and decreases mildew and browning dangers.



4. Silica gel dries a cleaned cotton carpet in 2 hours. A pound of this drying agent per square foot of carpet is spread between layers of cotton batiste on the wet carpet. After carpet is dry, vacuuming restores carpet pile. Silica gel may be used many times but must be dried after each use. New method works well on rayon, wool, nylon carpets.



Warming stock water

Where you put a stock waterer and how you operate it may make a big difference in the cost of keeping it ice free, USDA research shows.

ARS agricultural engineer L. B. Altman, working cooperatively with the Iowa Agricultural Experiment Station, at Ames, found that exposed tanks used as much as 673 kilowatt hours more energy for automatic electric heating over winter than waterers located on the south side or within a building. Where practical, it will pay to locate waterers in places sheltered from the wind.

It also saves quite a bit of electricity to bank the tank with straw, sawdust, or other good insulation.

Altman and Iowa animal husbandman G. C. Ashton also found that the practice of heating water to several degrees above freezing can waste much electricity. It's enough to keep the surface barely ice free. Various studies show that livestock is no better off with warmer water. So a thermostat setting that has current off at the temperature of incoming water saves money. Another way to prevent unnecessary heating is to turn off the power on all days when the temperature is well above freezing. Some farmers do this automatically with a thermostatically controlled switch operating on air temperature; others do it manually.

Some of these economy practices will also cut costs of other types of heaters. Altman says savings can add up to quite a bit in a winter.

Stubble beats drought

Despite 50-year-low precipitation during the 1955-56 season, stubble-mulched winter wheat yielded sur-

prisingly well in cooperative studies by USDA and the Kansas Agricultural Experiment Station, Fort Hays.

Wheat planted in stubble-mulched plots made good use of the abundant moisture present at planting time and, with only 4.6 inches of precipitation thereafter, yielded 13.8 bushels per acre. In contrast, one-way-disked plots yielded just 9.1 bushels, plowed plots 6.7 bushels of wheat.

Soil preparation was the only difference in plot treatment. Just after the September rains (before planting), moist soil was found to a depth of 34.6 inches in stubble-mulched plots, 25.1 inches in disked plots, and 25.5 inches in plowed plots. Tests the following April showed available moisture was 7.09, 5.29, and 5.99 inches in the respective plots.

Breeding tender meat

Meat tenderness is inherited and can be passed to succeeding generations through selective breeding.

So say USDA scientists studying the heritability of tenderness as an approach to production of animals that



will consistently produce tender meat. These researchers are trying to develop a quick, reliable tenderness test usable on live animals. A method now being explored involves taking biopsy samples—live muscle tissue—for laboratory analysis. Such a test would make slaughter unnecessary; animals that showed desirable tenderness characteristics could then be used as breeding stock.

Experiments have been made so far with rabbits and a few cattle at the

ARS Agricultural Research Center, Beltsville, Md. No major advances have yet been made in developing more tender beef animals by selective breeding, but ARS researchers are optimistic about the possibilities.

Killer for two weeds

A new herbicide called TBA—2, 3, 6-trichlorobenzoic acid—gave almost perfect control of weed bromegrass and wild garlic with little or no damage to desirable forage grasses in recent USDA tests. Although promising, this chemical is not yet recommended for use and is not commercially available to farmers.

Sprays of 4 and 8 pounds per acre of TBA controlled bromegrass effectively, and growth of such perennial weeds as horsenettle, oxalis, and mouse-ear chickweed was slowed down for the first half of summer. TBA did not damage Kentucky bluegrass appreciably, though the 8-pound treatment slowed growth somewhat.

Garlic was completely eliminated when TBA was used at 2 and 4 pounds per acre in both fall and spring as repeated treatments. Used in the fall only, TBA reduced garlic 46 percent when applied at the 2-pound rate and 90 percent at the 4-pound rate.

In all these treatments, TBA was diluted to 40 gallons per acre.

Maple flavor boosted

Controlled bacterial growth in maple sap can actually improve sirup flavor, according to USDA research.

The good flavor and light color of top-quality maple sirup can be spoiled by bacteria, yeasts, and other microorganisms, and elaborate precautions are taken to prevent their growth. But ARS bacteriologist L. L. Reed of

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the Eastern Utilization Research Branch, Philadelphia, showed that carefully controlled growth of *Pseudomonas* bacteria in sap for 10 days intensified the maple flavor. This bacterial growth also darkened the sirup. Unlike other dark maple sirups, however, the new product did not have any off-flavor.

In the meantime, however, USDA scientists are still studying ways to prevent darkening of maple sirup and loss of flavor during processing. Sirup darkens mainly because of the long time it must stay in conventional open-pan evaporators before it is finally concentrated to sirup.

Chemical engineers E. O. Strolle, R. K. Eskew, and J. B. Claffey of the Eastern laboratory have developed a new rapid evaporator for making high-grade and light-colored maple sirup. The new device converts partially concentrated maple sap to sirup in seconds. Sap is condensed in steam-heated tubes so quickly that there is no opportunity for heat to darken the color of the sirup.

Farmers on vacation

Farmers are taking vacations—at least 43 percent of the people surveyed by USDA in Michigan are. And per-



haps some day all farmers will be taking vacations—even if they are not

for full days, says ARS agricultural economist Earle Gavett.

Vacations ranged from 151 days to 6 hours a day for 3 days. Less than a fifth of the farmers took time in the winter; of these, 70 percent took full days—usually a week.

Three-fourths of those relaxing found time during growing and harvesting periods, April 1 through October 31. Almost 64 percent took full days—usually 4 to 7 days.

Winging after insects

Aerial operations against insects under State-USDA contracts in 1956 were the most extensive in history. Aircraft sprayed and dusted insecticides on some 5 million acres. Mediterranean fruit fly treatments added another 4 million, report ARS Plant Pest Control officials.

Last year's total of 9 million acres was more than double the 4.2 million acres treated in 1950 under Federal-State contract. Treatments totaled 1.9 million acres in 1951, 1.5 million in 1952, 1.4 million in 1953, 2.5 million in 1954, and 4.2 million in 1955. This does not include large acreages treated by air each year for farmers by commercial firms.

Four insects—grasshoppers, spruce budworms, Medflies, and gypsy-moths—were the chief targets. Smaller air attacks were made against the Mormon cricket, beet leafhopper, tussock moth, and spittlebug.

Technicians are continuing their studies to develop improved aircraft

and other methods for insect control, including better insecticide formulations and more efficient spray equipment. Studies also are underway on aerial application of seeds, fertilizers, and weed-killers as well as other types of farm chemicals.

New oat for the north

Bronco, a hardy new winter oat adapted to northern areas, is jointly announced by USDA and Texas Agricultural Experiment Station.

Bronco shows considerable tolerance to Victoria blight, produces high yields of good quality grain, and makes vigorous growth in northern



portions of areas where winter oats are seeded. The new variety is a hardy progeny of a Fulwin cross.

In tests at northern stations, Bronco averaged over 80 bushels an acre. This was 6.7 bushels more than its sister strain, Mustang, 8.1 more than Appller, a progeny of Red Rustproof. Bronco and Mustang yields at southern stations were nearly equal.

Bronco survived winter tests at northern stations 14 percent better than Mustang and was 8 percent hardier at southern stations. Mustang, which has already doubled Texas oat acreage, is still preferable in the southern winter-oat belt for good grain yields and winter pasture.